

UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
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FESCR 8104

STUDENT OUTLINE

REPAIR DELCO-REMY STARTER ASSEMBLY

LEARNING OBJECTIVE

1. Terminal Learning Objective: Given a Delco Remy Model 1990272 starter assembly, the required common and special tools, test equipment, precision measuring instruments, repair parts, shop supplies, TM 9-2320-297-34, and TM 9-2920-232-34&P, per information contained in the references, repair the starter assembly. (8.1.1)
2. Enabling Learning Objectives: Given a Delco Remy Model 1990272 starter assembly, the required common and special tools, test equipment, precision measuring instruments, repair parts, shop supplies, TM 9-2320-297-34, and TM 9-2920-232-34&P, per information contained in the references:
 - a. disassemble the starter, (8.1.1a)
 - b. inspect the components of the disassembled starter to determine their suitability for reuse, (8.1.1b)
 - c. test the components of the disassembled starter for serviceability, (8.1.1c)
 - d. repair or replace the unserviceable components as required, (8.1.1d)
 - e. assemble the starter from serviceable components, and (8.1.1e)
 - f. test the starter on an appropriate test bench. (8.1.1f)

OUTLINE

1. COMPOSITION AND DESIGN CHARACTERISTICS OF THE STARTER

a. The starter assembly used on, but not limited to, the MK48 vehicle engine is made by the Delco-Remy Corporation and is a Model 1990272.

b. Major Components

(1) Solenoid. The solenoid is an electrical magnetic switch that makes and breaks the circuit between the battery and starter. It also shifts the starter drive, causing it to engage with and disengage from the flywheel ring gear.

(2) Starter drive. The starter drive is an overrunning clutch that protects the motor from being spun too rapidly by the engine. It consists of rollers that ride between a collar on the pinion gear and an outer shell. The outer shell has tapered slots for the rollers so that the rollers can either ride freely or wedge tightly between the collar and shell.

(3) Armature assembly. This assembly is made up of many conductors of heavy copper ribbons that are mounted between iron laminations on an iron shaft. On one end of the armature is the commutator and mounted on the other end is the starter drive.

(4) Commutator. The commutator is a series of copper bars connected to armature windings. The bars are insulated from each other and from the armature. The brushes ride against the turning commutator.

(5) Brushes. The brushes are made from a carbon and graphite mixture. They are called brushes because they brush the commutator segments to make contact.

2. PRINCIPLES OF OPERATION OF THE STARTER ASSEMBLY

a. On the MK48, the starter is mounted on the left side of the flywheel housing. When the starting circuit is closed, a small drive pinion on the armature shaft engages with the teeth on the flywheel ring gear to crank the engine. When the engine starts, the overrunning clutch disengages the drive pinion to prevent the armature from over speeding and damaging the starter motor.

b. A solenoid, mounted on the starting motor housing, operates the overrunning clutch by linkage and a shift lever. When the starting switch is engaged, the solenoid is energized and shifts the starting motor pinion into mesh with the flywheel ring gear and closes the main contacts within the solenoid.

3. REPAIR AND TESTING PROCEDURES

a. Instructions

(1) Detailed instructions for repairing the starter assembly are contained in the manual that was issued to you at the beginning of this block of instruction. Follow those instructions carefully to effect those repair procedures on the training aid starter to which you have been assigned.

(2) Have the instructor assigned to your station check your work at each point designated in this student outline.

(3) Refer to TM 9-2320-297-34 for the procedures used to perform the repair steps listed. Use the index to locate the instructions in the manual and read the instructions carefully before performing each task.

b. Disassemble the Starter

(1) Remove the solenoid.

- (2) Disconnect the field leads.
- (3) Remove the lever housing.
- (4) Remove the end cap and brush holder assembly.
- (5) Remove the armature.
- (6) Remove the drive housing.
- (7) Disassemble the lever housing.
- (8) Disassemble the plunger assembly.
- (9) Inspect the oil reservoir cap and remove the felt wick only if the cap is loose.
- (10) Disassemble the end cap and brush holder assembly.
- (11) Inspect and test the field coil.
- (12) Disassemble the field frame and field coil assembly if the inspection and test results were not acceptable.

STOP! Have instructor initial.

c. Inspect the Starter Components

- (1) Inspect the housings.
- (2) Inspect the armature shaft.
- (3) Inspect commutator. Record measurements.
- (4) Test the armature for continuity, grounded condition and internal short.
- (5) Inspect the brushes and springs.
- (6) Inspect the bushings. Record measurements.

STOP! Have instructor initial.

d. Assemble the Starter

- (1) Assemble the field coil and field frame assembly if it was disassembled.
- (2) Test the field coil to make sure no damage occurred during reassembly.

STOP! Have instructor initial.

- (3) Assemble the end cap and brush holder assembly.
- (4) Install the armature.
- (5) Install the felt wick (if removed).
- (6) Assemble the plunger assembly.
- (7) Assemble the lever housing.
- (8) Install the drive housing.
- (9) Install the armature, brush holder and end cap.
- (10) Install the lever housing.
- (11) Connect the field leads.
- (12) Install the solenoid.

STOP! Have instructor initial.

e. Test the Starter Using the Alternator/Generator/ Regulator/Starter (AGRS) Test Stand.

NOTE: An instructor will be at your test stand to provide you with individual instructions and assistance while you test your starter.

- (1) Install the starter on the test stand.
 - (a) Position the starter on the cradle of the test stand and secure it with the starter clamp.
 - (b) Connect positive cable 1536 to the starter solenoid positive terminal and into the 24 volt positive socket of the test stand.
 - (c) Connect negative cable 1537 to the negative post on the starter and into the negative socket of the test stand.
 - (d) Connect cable 10641529 to the starter solenoid switch terminal and into the 24 volt socket of the test stand.
- (2) Check and adjust the pinion clearance.
 - (a) Make sure the louvers are in the open position and that all five air inlets on the test stand are open.

(b) Turn the test stand main power and the starter power supply main to the ON position.

(c) Turn the starter voltage switch to the 24V position and push button R on the starter timer meter.

NOTE: The test stand has a 30 second timer incorporated in the starter test system to protect the starter solenoid. Once the 30 seconds have elapsed, the test stand will automatically shut down the starter test system for a 2 minute cool down time. This 30 second timer starts when the starter solenoid switch or the starter test switch is placed in the ON position.

(d) Flip the starter solenoid switch to the ON position and, using a feeler gauge, check the pinion clearance and return the switch to the OFF position.

(e) If the pinion clearance is not within specifications listed in the technical manual for the starter, make the required adjustment and recheck the clearance.

(3) Perform the starter free run test.

(a) Using the 12% tap and 2-1/2% tap starter transformer switches, adjust the starter volts to 20 volts.

(b) Using the paint markers provided, paint the end of the armature shaft half white and half black. Then adjust the speed sensor until you have a defined red dot on the white side. Push the starter test button to see if the RPM register on the starter RPM meter. If they do not register, readjust the sensor and recheck.

(c) Push the starter test button, note the readings displayed on the starter AMPS and starter RPM meter, and release the button. Compare these readings with the specifications for the starter. If all specifications are met, the starter is serviceable. If a low-speed, high-current condition exists, check the armature for excessive arcing, grounds, and shorts; also check for armature drag and faulty bushings. If a low-speed, low-current condition exists, inspect for faulty connections and poor brush contact.

(4) Return all switches to their OFF position.

(5) Remove the starter from the test stand and return all cables to their original location.
Have instructor initial.

STUDENT REFERENCES:

TM 9-2320-297-34

TM 9-2920-232-34&P